Confidential Business Information (CBI)

Certification Test Report

Sherwood Industries

Freestanding and Insert Pellet Stove

Models: Chatham-1, Davenport-1, EF2-1, Kinderhook-1

Prepared for:	Sherwood Industries 6782 Oldfield Road Saanichton, British Columbia V8M 2A3 Canada
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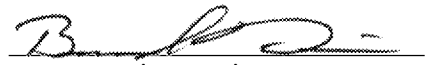
AUTHORIZED SIGNATORIES

This report has been reviewed and approved by the following authorized signatories:

Evaluator:



Bruce Davis, Testing Manager
OMNI-Test Laboratories, Inc.

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Sampling Procedures and Test Results

INTRODUCTION

Sherwood Industries retained OMNI-Test Laboratories, Inc. (*OMNI*) to perform U.S. Environmental Protection Agency (EPA) certification testing on the Chatham-1 freestanding, pellet-fired room heater.

The testing was performed at *OMNI*'s testing facility in Portland, Oregon. The altitude of the laboratory is 30 feet above sea level. The unit was received in good condition and logged in at the *OMNI*'s testing facility on June 6, 2016. It was assigned and labeled with *OMNI* ID #2205. *OMNI* representative Bruce Davis conducted the certification testing and completed all testing by July 15, 2016.

This report is organized in accordance with the EPA-recommended outline and is summarized in the Table of Contents immediately preceding this section. The results in this report are limited to the item(s) submitted.

SAMPLING PROCEDURE

The Chatham-1 was tested in accordance with the U.S. EPA 40 CFR Part 60, Subpart AAA – Standards of Performance for New Residential Wood Heaters using ASTM E2515 and ASTM E2779. The fuel used for certification testing was Lignetics hardwood pellet fuel; this fuel was graded as Premium by the Pellet Fuels Institute and was produced at registered mill #03434. Particulate emissions were measured using dual sampling trains consisting of two sets of filters (front and back). The results of the integrated test run indicate an average particulate emission rate of 1.44 g/hr. The Chatham-1 results are within the emission limit of 2.0 g/hr.

The model Chatham-1 was tested for thermal efficiency and carbon monoxide (CO) emissions in accordance with CSA B415.1-10. The heater has a demonstrated an average thermal efficiency of 76.7%. The calculated CO emission rate was 7.41 g/hr.

Efficiency results were calculated using spread sheet Version 2.2 created 12/14/2009 and distributed by CSA. Example calculations for CSA B415.1 were not provided by CSA; spreadsheet is protected from modifications by means of a password.

An ambient filter (Background) was not operated during this series, there were no operations in the area that would have generated additional particulate into the ambient air. Running an ambient filter can only reduce emissions by backing out any particulate not generated by fuel in the appliance, it can never increase emissions. Tests conducted without an ambient filter are considered worse case.

RUN DISCUSSION

Run 1 was an attempt at an integrated test run consisting of burn settings that result in 60 +5/-0 minutes at maximum, 120 +5/-0 minutes at medium (<50% of maximum), and 180 +5/-0 minutes at minimum. Each burn category in this run was achieved, meeting both time and burn rate requirements. Negative filter weights were not found, no sampling anomalies occurred, so this integrated test run is valid and appropriate per ASTM E2779 and no further test runs were needed.

SUMMARY OF RESULTS

The average particulate emission rate over the complete, integrated test run was measured to be 1.44 g/hr.

The average particulate emission factor for the complete, integrated test run was measured to be 1.46 g/dry kg of fuel.

The average thermal efficiency for the complete, integrated test run was measured to be 76.7%.

The particulate emission rate calculated from the one-hour filter was 3.61 g/hr.

CO emissions were calculated to be 0.123 grams per minute over the integrated test run.

The proportionality results and sample train agreement for the test run was acceptable. Quality check results for each test run are presented in Section 3 of this report.

SUMMARY TABLES

Table 1.1 – Particulate Emissions

	One-Hour Filter	Integrated Total
Emission Rate (g/hr)	3.61	1.44
Emission Factor (g/dry kg)	1.63	1.46

Table 1.2 – Efficiency and CO

	Burn Rate Segment			Integrated Total
	Maximum	Medium	Minimum	
Time (minutes)	60	120	180	360
Burn Rate (dry kg/hr)	2.21	0.95	0.61	0.99
Heat Input Rate (BTU/hr, HHV)	40,852	17,622	11,214	18,290
Heat Output Rate (BTU/hr, HHV)	32,134	12,655	8,852	14,033
Efficiency (%, HHV)	78.7%	71.8%	78.9%	76.7%
Efficiency (%, LHV)	84.2%	76.9%	84.5%	82.1%
CO Emission Rate (g/min.)	0.367	0.14	0.038	0.123

Table 1.3 – Test Facility Conditions

	Initial	Middle	Final
Room Temperature (°F)	75	75	78
Barometric Pressure (in Hg)	30.24	30.23	30.22
Air Velocity (ft/min)	< 50	< 50	< 50
Induced Draft (in H2O)	0	0	0

Table 1.4 – Fuel Measurement Summary

Segment	**Time** (min)	**Burn Rate** (dry kg/hr)	**Consumed Fuel Weight** (lbs)	**Fuel Moisture Content** (dry basis - %)
Pretest	60	2.21	5.1	4.735
Maximum	60	2.21	5.1	4.735
Medium	120	0.95	4.4	4.735
Minimum	180	0.61	4.2	4.735
Integrated Total	360	0.99	13.7	4.735

Table 1.5 – Dilution Tunnel and Flue Gas Measurements

Segment	Average Flue Draft (in H_2O)	Average Dilution Tunnel Gas Measurements		
		Velocity (ft/sec)	Flow Rate (dscf/min)	Temperature (°F)
Integrated Total	-0.029	17.51	196.6	88.2

Table 1.6 – Heater Configuration

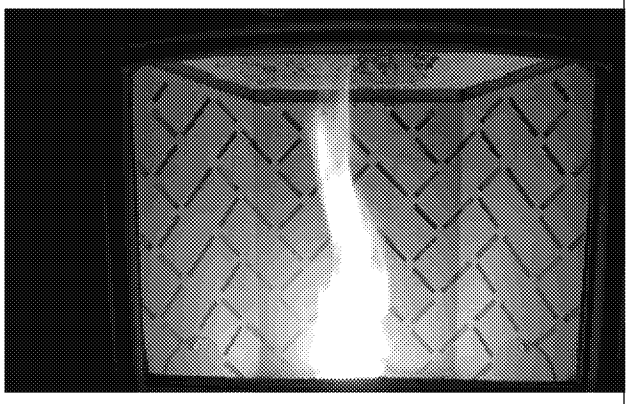
Segment	Heat Level	Feed Trim	Combustion trim	Manual air Slide
Pretest	5	5	2	Full Closed
Maximum	5	5	2	Full Closed
Medium	2	2	2	Full Closed
Minimum	1	1	2	Full Closed

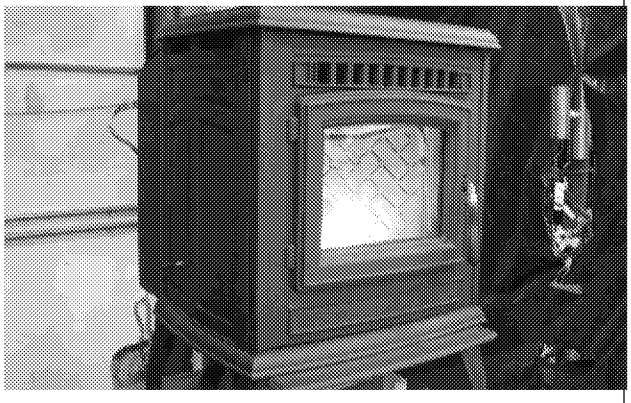
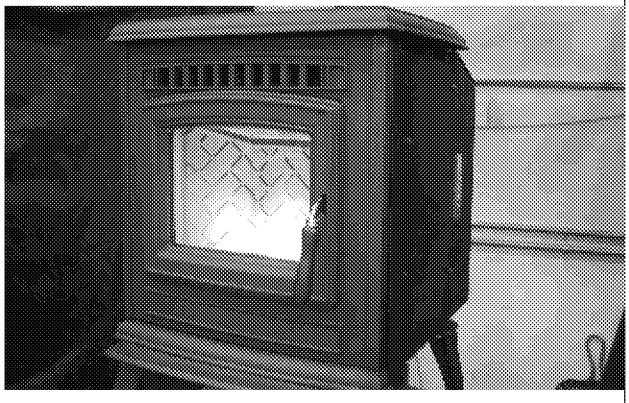
Section 2

Photographs
Appliance Description
Drawings

Sherwood Industries
Chatham-1

PHOTOGRAPHS

	
Chatham-1 Front	**Chatham-1 Back**

	
Chatham-1 Left	**Chatham-1 Right**

APPLIANCE DESCRIPTION

Appliance Manufacturer: Sherwood Industries

Pellet Stove Model: Chatham-1

Type: Freestanding, air-circulating type, pellet-fired room heater.

The Chatham-1's principle elements include a fuel hopper, mild steel firebox chamber, Stainless Steel burn pot, and electrical fuel feed, combustion air, and convection air supply systems.

Air is forced by the combustion air blower through a rectangular formed firepot with open ends and air passageways in the front, back, and bottom. Combustion products are routed out of the firebox chamber through a 3-inch diameter flue outlet located on the rear of the unit.

Fuel is supplied from the hopper to the burn pot via a semi vertical auger that delivers fuel to a drop tube. Fuel supply rate is varied by cycling the auger motor as needed.

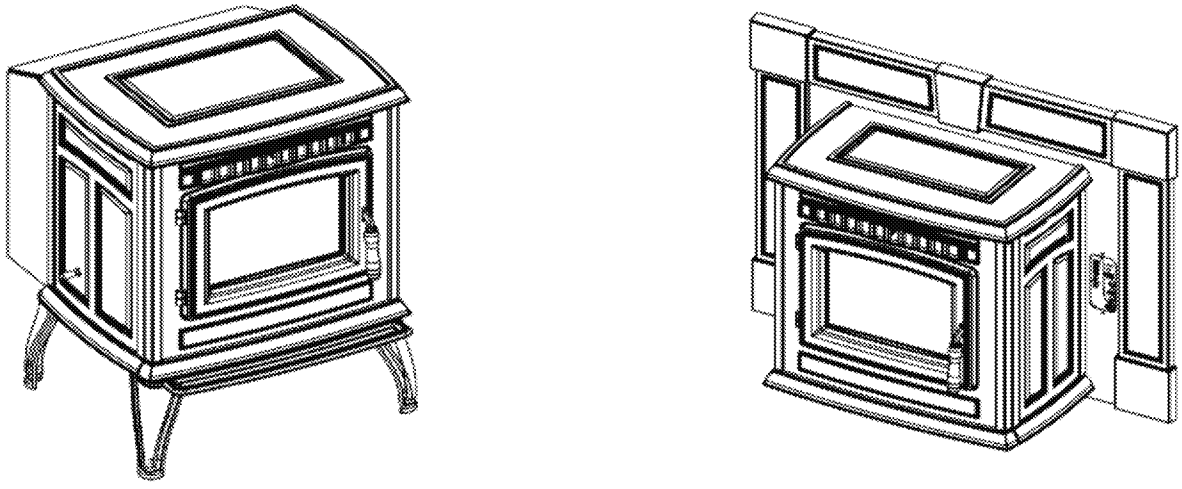
Ashes fall through the burn pot into a removable ash drawer located at the bottom of the unit. The drawer is accessed through the front firebox door, which also features a 390 mm x 229mm viewing window with a 19mm x 3.2mm u-shaped gasket that gives an air tight seal.

The electrical systems are regulated by a user-operated control board. On this board settings such as heat level, feed trim, and combustion trim settings can be adjusted to achieve desired heat output. The unit can also be controlled by an external thermostat system.

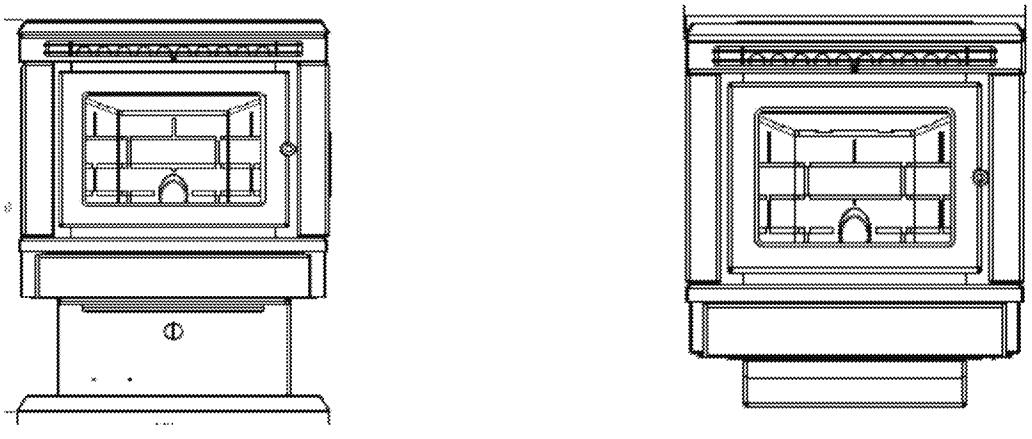
Similar Models: Three additional models share the same firebox, heat exchanger, feed system, air circulation motor, and products of combustion handling system. These models are the Hudson River Davenport-1, Hudson River Kinderhook-1, and the EF2-1. On the freestanding models external shields and legs/pedestal are the only changes. Insert models have shielding around the firebox area, the rear area around the motors is left open but would be within the confines of a fireplace when installed. Feed motors, and air handling motors are the same as used on the freestanding appliance.

See appliance drawings in section 2 for details.

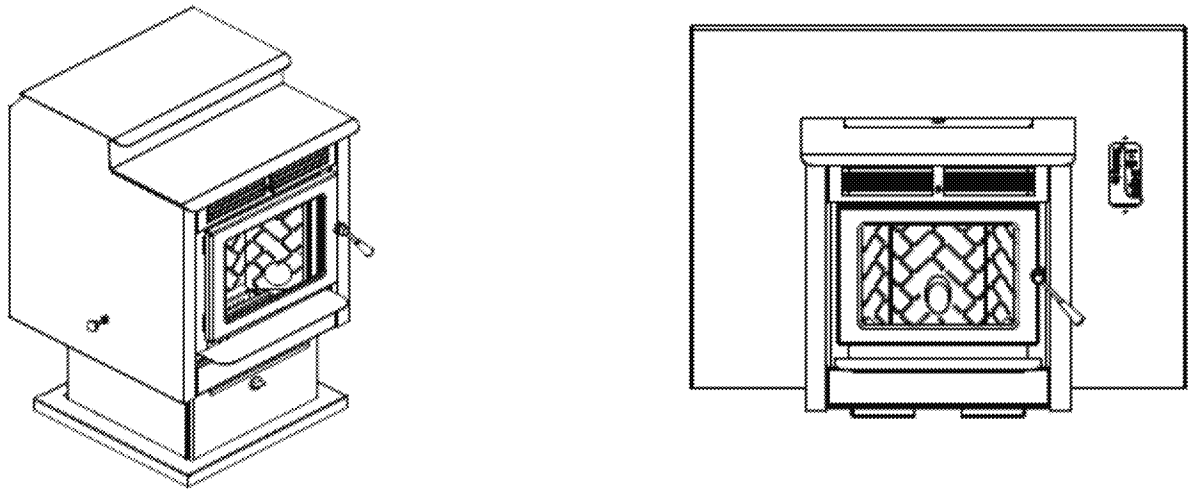
Model Similarity



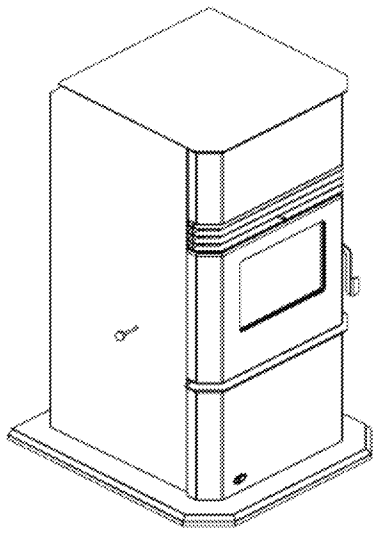
Chatham-1, Freestanding and Insert.



EF2-1, Freestanding and Insert.



Davenport-1, freestanding and insert.



Kinderhook-1, freestanding.